attempt is very laudable. Knowing how often mosses are found without fructification, he has endeavoured to rely upon characteristics afforded by the barren plant, and not upon those derived from the inflorescence or the capsule. Whether so important a part of the structure as the reproductive system can be safely neglected by the systematist, seems to us at least doubtful. One has heard the story of the man who boldly asserted that the peristomes of the mosses were created different in order to enable botanists to distinguish the species. That may be rash teleology, and certainly Mr. Jameson has not adopted it.

As the book is intended for beginners, we think that a glossary should have been given.

E. F.

OUR BOOK SHELF.

Report of Observations of Injurious Insects and Common Farm Pests, during the Year 1893, *with Methods of Prevention and Remedy.* By Eleanor A. Ormerod, F.R.Met.Soc., &c. Seventeenth Report. (London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd.).

ALTHOUGH the indefatigable Miss Ormerod, our principal English agricultural entomologist, has lately retired from the post which she has so long and so worthily occupied in connection with the Royal Agricultural Society, we are pleased to see that she has by no means relaxed her exertions in the cause, but has again brought out her usual annual volume, which will bear comparison with any of those which have preceded it, in the interest and value of its contents.

The year 1893 was remarkable for the great drought, which though it affected both vegetation and insect-life less than might have been expected, was necessarily favourable to the increase of some species, and injurious to others. The most noticeable feature was undoubtedly the unusual abundance of wasps over almost the whole of Great Britain and the adjoining countries; and thirty pages of Miss Ormerod's report are devoted to wasps alone. The remainder of this report treats of various insects infesting apple, bean, corn and grass, gooseberry, hop, mangold, mustard, pear, strawberry, tomato and cucumber, turnip and willow; and to the occurrence of locusts and mites (*Phytoptidæ*), not attached to particular plants. Most of the species noticed are freely illustrated in their various stages, so that there ought to be no difficulty about their identification, even by persons ignorant of entomology. Particular attention is given, as usual, to the best means of prevention and cure applicable to each case.

Fortunately the climate of England is less suited to the excessive multiplication of many insect pests which are highly destructive on the Continent and in America; and we are glad to notice that Miss Ormerod does not consider that the Hessian Fly, about which so much anxiety was felt a few years ago, is ever likely to become very destructive with us. Miss Ormerod also prints a letter from M. Schöven, announcing the introduction of this insect into Norway; another instance of the impossibility of preventing insect pests being carried by the constant international traffic from country to country, where they establish themselves if the climate and conditions are favourable, but if not, they soon die out, or linger on in too small numbers to be really injurious.

The introduction of locusts into England in brocoli from South Europe, and (dead) in large quantities among hay from Buenos Ayres, is likewise worthy of notice.

Mustard beetles, and others of the more familiar farm and garden pests, still continue to require and to receive a considerable amount of attention.

In conclusion, we may express our hope that Miss Ormerod may long be spared to issue many more of her useful annual contributions to agricultural entomology.

W. F. K.

On the Definitions of the Trigonometric Functions. By A. Macfarlane. (Boston: J. S. Cushing and Co.)

DR. MACFARLANE has already written on space-analysis. The previous papers were on the principles of the algebra of physics, the imaginary of algebra, and the fundamental theorems of analysis generalised for space. The pamphlet before us was read before the Mathematical Congress at Chicago, August 22, 1893.

In the first of the above-cited papers the author introduced a trigonometric notation. This has been discussed by Mr. Heaviside in the *Electrician* (December 9, 1892). Dr. Macfarlane, by way of rejoinder, remarks: "I believe that this paper will show that trigonometry is not an application of space-analysis, but an element of it; and that the ideas of this element are of the greatest importance in developing the higher elements of the analysis." Our readers may remember that the notation was also discussed by Prof. Alfred Lodge (NATURE, November 3, 1892). To this our author replies: "I consider that the notation is a matter not of secondary, but of paramount importance. If the notation is arbitrary, it gives us no help in the further development of analysis; if on the other hand it is systematic and logically connected with the existing notation of analysis, it points the way to more general principles and results. I believe that this paper will show that my notation is systematic and logical." The pamphlet occupies 49 pages, and there are some other passages like those we have excerpted; so there is likely to be a pretty fight, of which our readers will soon hear more, if they do not take part in the strife. The pamphlet will repay perusal.

Key to Mr. J. B. Lock's Shilling Arithmetic. By Henry Carr, B.A. (London: Macmillan and Co., 1894.)

IN the worked-out results which we have now before us, Mr. Carr has not restricted himself to giving the mere answers, but has inserted in all cases the steps by which they are reached. This, especially for beginners, will be found of great service, and by judicious use will certainly lighten the teacher's task. We have selected many of the more advanced examples here and there, and worked them out as a test of the accuracy of the results given, and have found no mistakes. Others, perhaps, may not be so fortunate, but all necessary care seems to have been taken to give the right answers. All who use Mr. Lock's shilling book will find it of great assistance.

LETTERS TO THE EDITOR.

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The Thermal Expansion of Diamond.

IN view of the interest at present aroused by M. Moissan's successful experiments upon the artificial production of diamond, I venture to recount the results of some observations upon the thermal expansion of diamond, which, I think, are suggestive in connection with the particular manner in which M. Moissan has achieved success. M. Moissan has shown that the added condition of high pressure has rendered a method previously unsuccessful now for the first time successful.

Minute particulars being out of place here, I may briefly say

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that the measurements given below were obtained by projecting, by aid of a 1″ objective, the image of a diamond, which was rather less than 2 mm. in extreme length, into a camera, so that it was enlarged upon the screen to 11 c.m. across. Two micrometer eye-pieces with movable wires were directed upon opposite corners of the image, the diamond being manipulated in the field of the object-glass till these corners were in sharp focus. A movement of the wires of the reading microscopes by one division of the head of the micrometer in following the expansion of the image corresponded to a diametral enlargement of this latter by 0·0005 c.m., but owing to imperfect focus of the image no more than 0·001 could be accurately determined. If the coefficient of expansion of the substance were 0·00001 (that of platinum, about) the expansion of the image, due to 10° C. change of temperature, is just determinable. It will therefore be understood that over a wide range of temperature considerable certainty in the readings could be secured.

The heating was effected by radiation from a platinum ribbon folded in such a manner that the substance under observation occupied the central point of a narrow platinum tube. The ribbon was heated by a current. A beam of light from a very small sphere—2 mm. in diameter—of incandescent lime (heated in an oxyhydrogen flame) entered the tubular oven from the back. The adjustment of this beam greatly decided the sharpness of the projected image. Temperatures were determined by melting substances of known melting-points in the oven, and reading the corresponding currents. Thus a curve of galvanometer readings plotted against temperature was obtained for subsequent use.

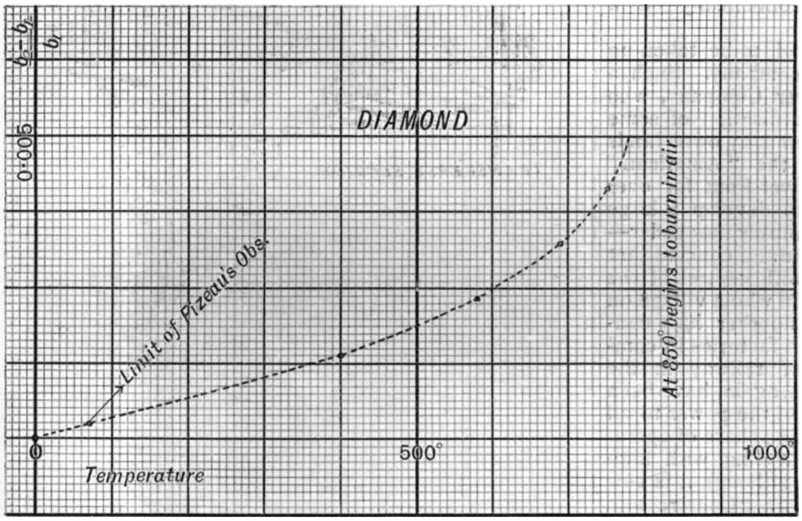

FIG. 1.

The results of the observations were four well-fixed points which give a curve (Fig. 1) seemingly tangential to Fizeau's results at low temperatures, but which curls up rapidly at about 750° C. At a temperature of 850°, and indeed below this, observations were stopped by the "efflorescence" upon the surface of the diamond of flaky particles which wriggled and twisted in a peculiar manner, finally disappearing. Once started, the "combustion" continued till the temperature of the oven was lowered to 712°. Cooling the oven, I subsequently photographed one face of the diamond. The picture obtained shows the face with a lamellar appearance, which was produced entirely by the heating, as at starting the faces were smoothly curved. Such an appearance is occasionally observed upon specimens of diamond. This photograph, as well as the curve of expansion, were shown at the *soirée* of the Royal Society in June 1892. The apparatus used was also shown in operation as applied to a minute globule of a melted basalt.

The sudden increase in volume or swelling-up of the diamond at high temperatures, suggests that the diamond is a form of carbon which has been subjected to high pressure when crystallising. Such changes we may expect to be reversible, and it is supposable that equilibrium at the higher density is only preserved by crystalline forces which will require to be brought into play by external conditions of pressure. It is probable that this is therefore an essential condition of success in its artificial production. It is perhaps of little interest to add that this reasoning gave rise to experiments—as I had leisure for them—which I only laid aside finally upon hearing of M. Moissan's success. I did not seek the aid of solution in a metal, but used an apparatus to compress graphite, as well as carbon prepared from sugar, between iron plates kept at a red heat, and urged together by the alternate heating and cooling of the bars of an iron yoke.

I am not without hope that the use of high pressure at a high temperature may ultimately prove sufficient—without resort to solution in a metal—to produce diamond. If the presence of a certain minute quantity of the carbide of a metal is essential, of course it will fail. It is difficult to imagine, however, that it should be essential. J. JOLY.

Trinity College, Dublin, March 5.

The North-East Wind.

PROF. BONNEY, in his "Story of our Planet," explains the prevalence of east winds at this season as being due to the low winter temperature of eastern Europe compared with the Atlantic coasts. If this explanation be the true one, we should expect the phenomenon to occur in December and January. My impression is, although I have no accurate statistics, that east winds do not prevail in those months in our climate. Further, we should expect, crossing the Atlantic in winter, to find for the same reason west winds prevailing off the American coasts. If this is not found to be the case, I would suggest the following as, if not the cause, at all events one of the causes, of the phenomenon in question.

The difference of temperature between the northern Arctic regions and the tropics, to which, combined with the earth's rotation, the north-east trade wind is supposed to be due, is necessarily greater in the spring months, February to June, than on the average of the year. Because in the Arctic regions, little or no heat being received directly from the sun between the autumnal and the vernal equinox, the maximum of cold should be attained in March or from February to April. In low latitudes these months are by no means the coldest. It is reasonable to expect that when this difference of temperature becomes accentuated, and the gradients, so to speak, steeper, the north-east winds which are due to it should become prevalent in higher latitudes than those to which the trade winds proper are usually confined. S. H. BURBURY.

The Suspension of Foreign Bodies from Spiders' Webs.

THE following instance of the use of a stone by a spider as ballast for its web is interesting.

A web was noticed stretched between two trees at a distance of about ten feet from one another. From it hung a thread about two feet long, and attached to its lower end was a small pebble about the size of a pea, the stone hanging free about four feet from the ground. The stone had evidently been made use of in this special manner by the spider for the definite purpose either of keeping the web taut, or as ballast to give it stability against the wind, for on lifting the stone to remove the pressure, it was observed that the web became limp and slack, and was stirred out of position by the least breath of air.

This was noticed by a score or so of members of the German "Turnverein" here, in the garden of whose premises the occurrence took place. R. PHILIPP.

Buenos Ayres, January 24.

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